tube T T; it reduces the space *a b* occupied by the gas, and is soon surmounted by droplets of the compressed gas, which unite into a little mass of liquid, *b*.

The following are the parts of the apparatus:—B, a block of malleable iron with strongly-resisting walls; E′, E, screw nuts which may be unscrewed to arrange the apparatus before using it; P P, very solid tripod which receives the apparatus; S, support of the bell G and the envelope M; N supplementary screw intended to close the hole in the joint R when the mercury is poured into the apparatus.

OUR ASTRONOMICAL COLUMN

THE ROYAL OBSERVATORY, CAPE OF GOOD HOPE.—Since the appointment of Mr. Stone to the directorship of this establishment, in 1870, not only have all arrears of observations with the transit-circle, first brought into use in 1855, been reduced and published, but Mr. Stone has lately issued the results of observations taken in 1875, and has thereby overtaken the position of publications of the Royal Observatory, Greenwich, and the Radcliffe Observatory, Oxford, which have been conspicuous amongst astronomical establishments for the expedition with which the great mass of work involved in the reduction of the observations has been performed, and the results given to the scientific public.

The chief work of the year was the continuation of the general re-observation of the stars in the *Cœlum Australe Stelliferum* of Lacaille, attention in 1875 having been directed to those stars lying between 145° and 155° of north polar distance at the present epoch, all of which appear to have been observed, usually three times in both elements, together with a number of other stars in the same zone, which, though not generally much below the seventh magnitude, were not observed by Lacaille. Mr. Stone mentions that stars within limits of N.P.D 135°–145° were observed in 1876, and stars between 125°-135° in 1877.

Should it be deemed advisable shortly to form another general catalogue of stars, similar to the British Association Catalogue, say to stars of the seventh magnitude inclusive, Mr. Stone's recent volumes will be of the utmost value in extending the precision now attainable for such stars in the northern hemisphere to the southern heavens, not only as regards positions for the present epoch, but in the determination of proper motions of a considerable number of stars by comparison with Taylor's catalogues, which have not yet been systematically examined for that purpose. And we will take this opportunity of expressing the hope that if another catalogue like the B.A.C. should be undertaken, the time, labour, and expense involved in the preparation of so-called star-constants may be avoided, and attention paid instead to a more general and systematic investigation of proper motions, which, it can hardly be doubted, must lead to results of great interest and importance.

THE TOTAL SOLAR ECLIPSE OF JULY 29.—It was mentioned in NATURE last week that facilities would be afforded to intending observers of this phenomenon near Denver, Colorado, one of the chief places included in the belt of totality in the United States, and situated on the Pacific line of railway. By the elements of the *Nautical Almanac* the track of central eclipse appears to pass about twenty-five miles south of Denver, assuming its longitude from Greenwich to be 7h. om. 20s. W., and latitude 39° 48′, and at Denver the total phase commences at 3h. 28m. 14s. local mean time, and continues 2m. 45s., with the sun at an altitude of 42°; the circumstances by the elements of the American ephemeris are almost identical, as indeed was to be expected seeing that the moon's place in the latter work differs from her place in the *Nautical Almanac* by only + 3″·4 in R.A. and + 1″·0 in decl. and the sun's place by − 1″·1 in R.A. and + 0″·3 in decl., while the semi-diameters employed are each less by about 2″. In the American ephemeris the lunar tables of Peirce and the solar tables of Hansen are employed.

The northern and southern limits of totality in the eclipse of July 29, with the duration of total phase upon the central line, for nearly the whole track across the North American continent will be found at p. 400 of the *Nautical Almanac* for 1878.

CHEMICAL NOTES

TEMPERATURE OF FLAMES.—In the *Gazetta chimica Italiana* an account is given by F. Rosetti of some experiments on the above subject. To examine the temperatures he employs a thermo-electric element consisting of an iron and a platinum wire wound closely together and connected with a galvanometer. This latter was graduated to various temperatures by observing the deviation consequent on bringing the element in contact with a copper cylinder heated to known temperatures; these being determined by introducing the cylinder into a calorimeter. With such an arrangement he has investigated the flame of a Bunsen's burner, finding that in the same horizontal strata there were but slight alterations in the temperature, with the exception of the dark interior portion. Thus, where the external envelope showed 1,350°, the violet portion of the flame was 1,250°, the blue 1,200°, but the internal portion much lower, its temperature gradually decreasing from the base of the flame upwards. A flame produced by the combustion of a mixture of two volumes of illuminating gas and three volumes of carbonic oxide, showed a temperature of 1,000°.

STARCH IN PLANTS.—Botanists have hitherto held that all the starch in the chlorophyll cells of the leaves of plants is a product of the direct assimilation of carbon dioxide and water, basing this belief on the fact that the starch in these cells disappears when the plants are deprived of the power of assimilating carbon dioxide, but reappears on their exposure to light in an atmosphere containing that substance. Prof. Bohn, of Vienna, in a recent number of the *Deut. chem. Ber.*; throws some doubt on this conclusion by experiments he has made on the leaves of the scarlet runner. His results show that if the primordial leaves of this plant are shaded from light, the starch at first entirely disappears; after a few weeks, however, the chlorophyll cells of these shaded leaves show almost as high a percentage of starch as the parts of the plant which have been exposed to light. These observations demonstrate, therefore, that starch can be formed in the leaves from matter which has already been assimilated, and has entered into the leaf after its removal from the sunlight.

SIPYLITE, A NEW MINERAL CONTAINING NIOBIUM.—Mr. Mallett has found this mineral among some quantities of allanite from Amhurst county, Virginia. A few crystals have been obtained, but as they are of rather imperfect nature the measurement of the angles has only been attempted in a rough manner. The mineral in the mass was of a brownish black nature, but in thin plates it exhibited a reddish-brown colour, and possesses a pseudo-metallic lustre. The hardness is estimated at about 6, and the specific gravity as equal to 4·89. From the results of analyses Mr. Mallet considers that placing together the acid oxides of niobium, tantalum, tungsten, tin, and zirconium, reducing the basic oxides to equivalent amounts of dyad oxides, and eliminating the water, the following ratio may be obtained:—$R''O : M^{v}_{2}O_{5} = 221 : 100$, leading to the formula $R''_{3}M^{v}_{2}O_{8} . 4R''_{2}M^{v}_{2}O_{7}$, that is a single group of orthoniobate associated with four of pyroniobate. If the water be taken into account in the calculation and considered basic, then placing it on the same footing as the dyad oxides, we should have the

relation $R''O : M^{v}_{2}O_5 = 311 : 100$, or nearly 3 : 1, thus giving the simple formula $R''_3M^{v}_{2}O_8$; this latter the author considers the more probable. Whatever formula, however, may be taken for the mineral it differs from niobates hitherto described, the one view making it an approach to a simple pyroniobate, the other making it an orthosalt like Fergusonite, but partially acid in character, or containing basic hydrogen.

MOLYBDENUM.—The atomic weight of this metal has hitherto been quite uncertain, some chemists regarding it as 96, others as 92. Fresenius, the leading authority in analytical chemistry, has always adopted the latter number. Prof. Rammelsberg, of Berlin, has lately settled the question by careful experiments on the reduction of molybdic acid in an atmosphere of hydrogen, and has found 96 to be the correct atomic weight, – 96·18 being the exact number obtained. Taking this number as a basis, he has sought to solve the problem of the composition of the yellow phospho-molybdate of ammonium, which is used generally for the determination of phosphoric acid, and the exact formula of which has never been satisfactorily determined. A large number of analyses of the ammonium salt and the corresponding potassium salt show that the composition is undoubtedly

$$3(NH_4)_2O + P_2O_5 + 22MoO_3 + 12H_2O.$$

RELATIONS BETWEEN THE VOLUMES OF SILVER SALTS.—H. Schröder communicates an interesting series of observations on this subject in the *Berichte der deutschen chemischen Gesellschaft*, for November, from which it appears that the atomic volumes (*i.e.*, the quotient resulting from the division of the molecular weight by the specific gravity) of these salts are all simple multiples of the atomic volume of silver, or rather of its half atomic volume, 5·14. In the fatty series an accession of CH_2 to a compound increases the atomic volume by $3 \times 5{\cdot}14$. For example :—

$C_2H_3AgO_2 = 10 \times 5{\cdot}14 = 51{\cdot}4$
$C_3H_5AgO_2 = 13 \times 5{\cdot}14 = 66{\cdot}8$
$C_4H_7AgO_2 = 16 \times 5{\cdot}14 = 82{\cdot}2$
$C_5H_9AgO_2 = 19 \times 5{\cdot}14 = 97{\cdot}7$, &c.
$C_6H_5CAgO_2 = 20 \times 5{\cdot}14 = 102{\cdot}8$
$C_4H_4Ag_2O_4 = 17 \times 5{\cdot}14 = 87{\cdot}4$.

ORNITHURIC ACID.—Prof. Jaffe, of Königsberg, in the course of experiments on the transformation of organic bodies on passing through the digestive organs of fowls, has obtained a new acid in a way decidedly different from the usual methods of chemical synthesis. Benzoic acid, C_6H_5COOH, which has been given to birds, is found to be entirely changed by passing through their organisms into a new and well-defined acid, which crystallises in colourless needles, forms a series of salts, and receives the name ornithuric acid. It appears to arise from the combination of benzoic acid with a base $C_5H_{12}N_2O_2$, present in the system, and which can be separated from ornithuric acid by treatment with hydrochloric acid. The formation is as follows :—

$$2C_6H_5COOH + C_5H_{12}N_2O_2 = C_{19}H_{20}N_2O_4 + 2H_2O.$$

DISTILLATION OF ORGANIC LIQUIDS BY MEANS OF STEAM.—Prof. Naumann, of Giessen, describes, in a recent series of papers in the *Berichte der deut. chem. Gesellschaft*, the results of his observations on the phenomena attendant on the passage of steam through organic liquids. As is well known to the experimental chemist, aqueous vapours, on passing through a liquid, carry with them frequently large portions of the latter, even when it boils at a temperature far above that of water—aniline, for example, at 180°. The process also is one of every-day occurrence in the organic laboratory, being used for the purpose of separating such liquids from their impurities. Prof. Naumann has studied in this connection liquids both specifically lighter and heavier than water, as well as liquids boiling below and boiling above 100° C., recording the physical phenomena produced by the passage through each of a regular current of steam. In all cases he finds them obeying a few invariable laws, viz., 1°. For every mixture of a liquid with water there is a constant boiling-point, which is below that of the lower boiling liquid ·2°. A constant ratio exists between the respective quantities of the two liquids found in the distillate ·3°. The temperature of the distilling vapours is always slightly higher than that of the mass of liquid. From among the numerous results the following will convey a general idea of the experiments. The first column contains the boiling points of the respective liquids, the second the temperature of the liquid while steam is being passed through it, and the last the number of cubic centimetres of the liquid found in the distillate for every 100 c.c. of water :—

Benzene	79·5 ...	68·5 ...	8·5
Toluene	108·5 ...	82·4 ...	21·2
Xylene	135·5 ...	89 ...	44
Nitrobenzene ...	205 ...	98·5 ...	14

An attempt was made to discover a connection between the molecular weights of the three first hydrocarbons of the aromatic series and the respective quantities of these liquids in the distillates, but without success. While studying the relations of the numbers yielded by the experiments, Prof. Naumann finally discovered that all the liquids obeyed a general fixed law, viz., *when a liquid is distilled by means of steam, the ratio between the volumes of the liquids and the water in the distillate, expressed in multiples of their molecular weights, is equal to the ratio between their vapour-tensions at the temperature at which the distillation occurs.* It is at once evident that by the discovery of this law the chemist is placed in command of a most valuable auxiliary for determining the constitution of a variety of compounds at present to a certain extent doubtful. The law holds equally good for any liquid the vapour of which is used instead of that of water.

GEOGRAPHICAL NOTES

EARLY AFRICAN EXPLORER.—Don Marcos Ximenez de la Espada of Madrid is now having printed a document of extraordinary interest for geographical science, viz., an account of the travels of an unknown missionary, of the fourteenth century, which Don Marcos has recently discovered. The enterprising author, in the years from 1320 to 1330, undertook extensive travels in Africa, not only along the west coast to Sierra Leone and thence to Dahomey, but also, it is stated, from the mouth of the Senegal river straight across the interior of the great continent. He visited the Soudan States, got as far as Dongola, and thence proceeded down the River Nile, finally reaching Damietta.

AFRICAN EXPLORATION.—In reply to a question from Mr. H. Samuelson last Friday in the House of Commons, the Chancellor of the Exchequer stated that it was not the intention of Government at present to devote any public money to African exploration. We can hardly expect that they would in the present state of public affairs; and even if they could it would be difficult to see in what direction they could take action. There are many expeditions of various kinds in the African field at present, working away with little or no connection with each other; even the International African Association has not been able to organise them, but is simply sending out more expeditions. There seems to us to be considerable waste of power and resources here.

MR. STANLEY.—The Geographical Society's dinner to Mr. Stanley is to take place on February 9. Arrangements are being made to accommodate the Fellows and